Mechanical Removal Equipment

Environmental/closed buckets are assumed for mechanical dredging of sediments in order to lessen releases of contaminants to the water column. In the alternatives, dredging is applied in a variety of environments, including both inside and outside the navigation channel. For FS-level approximations, two types of dredges are assumed. Articulated fixed-arm dredges are a preferred dredging option due to the greater bucket control that can be achieved with this dredge type versus cable-operated dredges. This greater bucket control has proven to limit contaminant resuspension and release at other sediment sites (AMEC et al. 2012; USACE 2008). Buckets deployed from articulated fixed-arm dredges tend to be on the order of 1 to 10 cubic yards (cy) in volume, depending on the size of the articulated fixed-arm dredge and the nature of the project (Fuglevand and Webb 2012). A 4 cy bucket size is assumed for this dredge type in the FS, although smaller or larger buckets may be appropriate based on site conditions. These site conditions may include proximity to structures, presence of debris, size of work area, and whether dredging takes place in open water.

Cable-operated dredges are assumed for those site conditions where fixed-arm dredges are not viable, including the navigation channel and where water depths exceed 40 feet. This FS also assumes that cable-operated dredges will have no water depth limitations at the Site and will have a bucket size of 10 cubic yards.

Land-based excavators are assumed to be used for removal of contaminated riverbank materials or near-shore sediments in locations above water levels to limit offsite transport of disturbed riverbank materials by the river. The removal of riverbank material is assumed to be conducted in the late summer and early fall when the river stage is assumed to be low. Riverbank material removal is assumed to occur in parallel with water-based dredging activities and, as such, are not factored in to construction duration calculations.

Productivity

Dredge productivity represents the rate at which sediment (as measured in-situ) is removed through dredging. The daily rate is a function of the type of dredge, operational characteristics, and length of work day. Production rates directly affect project duration and costs (Palermo and Hayes, 2014).

The duration of the dredging season is assumed to be 123 days. This is based on an in-water fish work window established for the Willamette River of July 1 through October 31. This in-water work window accounts for fish migration patterns and may be refined following discussions with the relevant technical experts from the natural resource trustees. Daily dredge production rates were developed assuming a 55/45% mix of cable arm versus articulated bucket dredges, based on the approximate areal percentages of navigation channel and maintenance dredge areas in the alternatives. Dredging and excavation operations are assumed to occur 24 hours/6 days per week using three dredges. The daily and weekly durations of removal operations may be refined if community “quality of life” concerns (such as nighttime noise or light pollution) are

identified. However, for this FS, it is assumed that 24 hour per day dredging activities can be achieved given the industrial nature of the majority of the surrounding areas.

The planning-level productivity estimate for a cable arm dredge was developed based on operational characteristics for environmental dredging and guidance presented in USACE (2008). The production rate is the product of the bucket volume (10 cy), cycle time (2 min), and percent bucket fill (60 percent), adjusted for effective working time (62.5%). Based on this analysis, the cable arm dredge productivity rate is approximately 2,700 cy/day/dredge plant. The productivity estimates of the articulated bucket dredge are derived from recent site experience at Boeing Plant 2 removal at the Duwamish River Superfund Site. There, the daily production rate during the latest season of dredging was approximately 1,150 cy/day using a single 4-cy excavator-mounted bucket. Assuming, the above number and mix of these dredge types, 6,000[1] cy/day was estimated for daily production.

At the Portland Harbor Site (and any environmental dredging operation), it's necessary to consider the dredge productivity in concert with the entire sediment handling and disposal train (NRC 2007). Overall, the transport, dewatering, storage, treatment and disposal facilities need to be designed to accommodate production rates.

Fuglevand, P. F. and R. S. Webb. 2012. Urban River Remediation Dredging Methods That Reduce Resuspension, Release, Residuals, and Risk. Proceedings of the Western Dredging Association (WEDA XXXII) Technical Conference and Texas A&M University (TAMU 43) Dredging Seminar, San Antonio, TX.

Palermo, M and Hayes, D.F. 2014. Sediment Dredging, Treatment, and Disposal. In: Reible, D.D., Ed. *Processes, Assessment and Remediation of Contaminated Sediments*. Springer, 2014.

[1] [(55% * 2,700 cy/day) + (45% * 1,150 cy/day)] * 3 dredge plants = 6,000 cy/day